deals with religious legends and traditions of the human race. This seems out of keeping with the rest of the work, which, though planned for a semi-popular audience, contains much matter of equal value to ecologists with the works of Haberlandt, Schimper, and Warming. The figures are crude and unsatisfactory in the extreme, when compared with Schimper. Though little that is new is to be found in Costantin's new volume, one finds there one of the best summaries we have of many topics, such as lianas and parasites. In the author's philosophy, also, is a great deal of valuable suggestion to all who are interested in ecology.—HENRY C. COWLES.

Organography.

TO THE admirably selected series of German botanical works translated into English for the Clarendon Press, the directors have now added Goebel's *Organography of Plants*.[4] This book is the only recent one dealing with morphology in its modern revival under the influence of experimental physiology. We have already written at length of the first part of this work upon its appearance,[5] and nothing need be added now.

The translation is by Professor Isaac Bayley Balfour of the University of Edinburgh, and in the main is very satisfactory. Intensification or weakening of the author's meaning occurs here and there; an occasional archaism, like "the seldom occurrence," p. 63, has crept in; now and then one finds a badly constructed sentence, as "one would naturally expect that a lateral shoot removed from the shoot system and planted vertically and which rooted would behave similarly," p. 51; and we much regret that the incorrect form "Spermaphyta" should be given further currency by the translator. But these defects are such as may be charitably overlooked in view of the great advantage of having this classic in English dress. We trust that the publication of the second part (with its promised index) will be made possible at an early day by the appearance of the remainder of the second part from the author's hand. The imprint of the Clarendon Press is guarantee that the manufacture of the book is all that can be desired.—C. R. B.

NOTES FOR STUDENTS.

M. H. DEVAUX has recently made an extensive study of lenticels, especially as concerns the physiological conditions of the growth and differentiation of their tissues, the results of which occupy two thirds of a volume of the *Annales des Sciences Naturelles*.[6]

[4] GOEBEL, K.: Organography of plants, especially of the Archegoniatæ and Spermaphyta. Authorized English edition by ISAAC BAYLEY BALFOUR. Part I: General Organography. Roy. 8vo. pp. xvi + 270. *figs. 130*. Oxford: The Clarendon Press. 1900.

[5] BOT. GAZ. **25**: 290. 1898.

[6] DEVAUX, H.: Recherches sur les lenticelles; étude sur les conditions physiologiques de l'accroissement et de la différenciation de la cellule et des tissus. Ann. d. Sci. Nat. Bot. VIII. **12**: 1–240. *pl. 6*. 1900.

The memoir is too voluminous to permit an adequate summary in the space at command, and the original should be available in every laboratory where research is prosecuted. Devaux gives a résumé of his work in the final chapter, from which some extracts are here made.

Lenticels are found in all the great groups of vascular plants and on all their organs which have secondary growth. The primary number on the stem is in ratio with the vigor of growth (indicated by the length of shoots or internodes), with the total number of internodes, and with the numerical rank of each internode. The curve of their production agrees closely with the curve of elongation of the internode, though the maxima do not exactly coincide. In each internode the lenticels are almost always more numerous on the distal moiety. The dimensions attained by lenticels depends directly on their number per unit of surface.

Two types are distinguished: (1) the closing layers are few in number, consisting of cells intimately united, with no (or small) intercellular spaces, being oftentimes comparable to true cork; (2) the closing layers are numerous, composed of rounded cells with many large intercellular spaces, and are like the packing cells (*Füllzellen; cellules comblantes*), but suberized. The packing cells are alike in both.

As to origin, lenticels are primary or secondary. Primary lenticels are formed early and at points determined by an organ (stoma, rootlet, less often a bud). Secondary lenticels are formed later and at points not determined by an organ. Whenever stomata are present there is a tendency to produce lenticels below them, usually in the cortex, sometimes in the pericycle. If stomata are very numerous, partial or complete abortion of some lenticels may occur. Some stems, wanting stomata, produce lenticels late, in the neighborhood of a bud after the fall of the leaf. Lenticels are likewise generally produced at the base of young rootlets, though equally subject to abortion. Lenticels are continually growing and continually being destroyed. The growth is due to continuous proliferation of the cells, the destruction to death or suberization of the cells. For the most part, proliferation produces complete rupture of the closing layers, especially in the spring, followed by hypertrophy, death, or suberization (accompanied or not by sclerosis), and by centripetal displacement of the cambium or its transformation into permanent tissue, to be regenerated later at a deeper level.

The lenticels are usually porose, but sometimes a complete closure occurs, not in winter only but throughout the year. Thanks to this porosity they certainly serve in large measure in the general gaseous exchanges of the organs. But it would be false to say that the lenticels exist for these exchanges. For (1) they are often absent or insufficient; (2) often the plant has porose regions different from lenticels; (3) opening and closing of the lenticels is not due to the needs of aeration. Rather they are organs of transpiration and automatic regulators of the internal moisture, which the

plant uses efficiently for the proper gaseous exchanges also. (M. Devaux promises a further memoir on the general aeration of the plant by lenticels.)

Finally, lenticels are defined as small limited regions of the superficial parenchyma in continual proliferation and continual development, capable of hypertrophy or of cicatrization, according to the conditions of external or internal humidity.—C. R. B.

A RECENT PAPER[7] on the embryology of *Taxus baccata* fills in some of of the gaps in previous accounts. The writer secured an abundance of wild material, but employed rather primitive methods in making his preparations, fixing in absolute alcohol, imbedding in celloidin, and staining in haematoxylin. The following is a brief résumé of his work.

The origin of the aril shows it to be a second integument. In tracing the development of the embryo sac the author was not able to get the earliest stages. The two, four, and eight-celled stages of the embryo sac were not observed, but many sacs were observed in later stages. Free nuclear division continues until there are about 256 free nuclei in the sac (the eighth division), when cell walls begin to appear. These cells rarely contain more than one nucleus, and have a regular six-sided appearance in optical section. In the later stages of endosperm formation the cells are often multinucleate. The formation of archegonia begins at the end of May or the first of June, but archegonia in very different stages of development are soon found in the same prothallium, even embryos and young archegonia often appearing together. The usual number of archegonia is from five to eight, but nine, ten, and even eleven were observed. Pollination occurs from the beginning to the middle of March, and there is no so-called pollen chamber. By the end of May three nuclei can be seen in the pollen tube, the tube nucleus, and the nuclei of the stalk cell and of the generative cell. Shortly before fertilization occurs the generative cell divides into two very unequal cells. Fertilization takes place about the first of June. There may be several pollen tubes, and several "archegonia" may be fertilized. The sex nuclei, which are of about the same size, come into contact and then sink to the bottom of the archegonium, where fusion takes place. Nuclear division then proceeds until there are from ten to sixteen free nuclei at the base of the archegonium, after which the free cells become arranged into tiers, the upper tier ("rosette"), the middle tier, consisting of suspensor cells usually six in number but sometimes more, and the lower tier, which is the embryo proper. In *Taxus baccata* all the suspensors of one archegonium belong to a single embryo. There are normally two cotyledons, but in one case three were observed.—CHARLES J. CHAMBERLAIN.

[7] JÄGER, L.: Beiträge zur Kenntniss der Endospermbildung und zur Embryologie von *Taxus baccata* L. Flora **86**: 241–288. *pls. 15–19*. 1899.

KAHLENBERG AND AUSTIN have been continuing the earlier researches on the toxic action of various substances on seedlings. They conclude [8] that the toxicity of acid sodium salts is greater than it ought to be if it were due solely to H ions and that the theory of electrolytic dissociation is unsatisfactory in explaining the poisonous action of these acid salts and of acids as well. The true explanation, they suggest, is very likely to be found in the ability which the substances all have in common, to neutralize basic substances. This explanation is independent of the theory of electrolytic dissociation. Kahlenberg also found himself unable to explain the sour taste of acids on the basis of the H ions[9] and holds the physiological effect to be due to their chemical activity in virtue of the fact that the H is replaceable by a metal of a basic radical. The more readily the H is replaced, the more reactive the acids are and the more intense is their taste.—C. R. B.

DR. GINO POLLACCI published a year ago the results of some of his researches on photosynthesis [10] which have not been adequately noticed in this journal. His most important results are as follows:

Green organs of plants which grow in sunlight give the aldehyde reaction with Schiff's reagent. Under the same conditions fungi do not so react; nor do leaves, kept for some hours in darkness or in an atmosphere free of CO_2. Formic aldehyde reactions are also obtained from expressed sap by proper treatment. He holds, therefore, that formic aldehyde is produced by green organs under the normal conditions of photosynthesis, and promises to give the results of his researches on the process of its formation in a second memoir—C. R. B.

THE CORRECTION of a large number of typographical and other errors, both of omission and commission, in Engler and Prantl's *Pflanzenfamilien*, especially in the general index, will be found in *Allgemeine Bot. Zeitschrift* **1900**: 110 *et seq.* Otto Kuntze and Tom von Post are the ferrets. Though inclined to magnify and multiply the errors, which they figure at 9315 (!), they have done a service for bibliographic work which will doubtless save users of the *Pflanzenfamilien* some hours and much bad temper.—C. R. B.

[8] Jour. Phys. Chem. **4**: 553–569. 1900. [9] Jour. Phys. Chem. **4**: 533–537. 1900.

[10] Atti Instituto Botanico de Pavia N. S. 7: (1–21). 1899.